

This Page Is Inserted by IFW Operations  
and is not a part of the Official Record

## BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- **BLACK BORDERS**
- **TEXT CUT OFF AT TOP, BOTTOM OR SIDES**
- **FADED TEXT**
- **ILLEGIBLE TEXT**
- **SKEWED/SLANTED IMAGES**
- **COLORED PHOTOS**
- **BLACK OR VERY BLACK AND WHITE DARK PHOTOS**
- **GRAY SCALE DOCUMENTS**

**IMAGES ARE BEST AVAILABLE COPY.**

As rescanning documents *will not* correct images,  
please do not report the images to the  
Image Problem Mailbox.

Searching PAJ

Page 1 of 1

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-042350  
 (43)Date of publication of application : 15.02.2000

(51)Int.Cl.

B01D 53/34  
 B01D 53/77  
 A61L 9/00  
 B01D 47/05  
 B01D 53/18  
 F24F 3/14  
 F24F 3/16

BEST AVAILABLE COPY

(21)Application number : 10-218937

(71)Applicant : TOYO NETSU KOGYO KK

(22)Date of filing : 03.08.1998

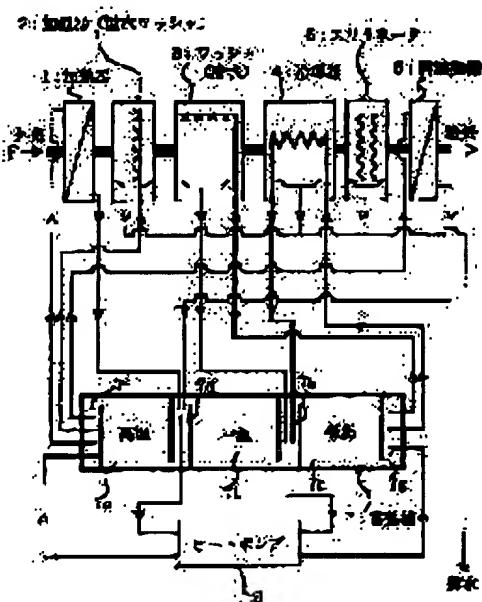
(72)Inventor : YANAGIHARA SHIGERU  
 IMAI TOMOMASA  
 IWAMIYA MASAHIRO

## (54) AIR PURIFYING DEVICE

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To effectively remove a harmful gas by heating air to be purified and humidifying the air in the heated state to sufficiently exhibit gas adsorption action based on the principal of nucleus condensation.

**SOLUTION:** The temp. of outside air to be purified flowing through an air passage F is increased by a heater 1 at first to make such a state that absolute humidity can be increased by adding a lot of steam component. Air in a supersaturated state is obtained by atomizing hot water by a humidifier 2 provided in the succeeding flow side of the heater 1. The steam molecule in the air in the supersaturated state is condensed and grown by the nucleus condensation action and the harmful gas is adsorbed by the condensed steam molecule. Next, the outside air from which the harmful gas is removed by the discharge of the condensed water with two stages of cooling action by a washer 3 and a cooler 4 and the succeeding discharge of the condensed water with an eliminator 5 is passed through a re-heater 6 to be re-heated and supplied to a clean room.



## LEGAL STATUS

[Date of request for examination]

03.08.1998

Searching PAJ

Page 2 of 2

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 2996955

[Date of registration] 29.10.1999

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

BEST AVAILABLE COPY

**\* NOTICES \***

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

**CLAIMS**

---

**[Claim(s)]**

[Claim 1] The air cleaner characterized by establishing a heating means, a heating humidification means, a cooling humidification means, a cooling means, and a reheating means in order along the passage of air.

[Claim 2] The aforementioned heating means consists of a warm water coil, and the aforementioned heating humidification means consists of a warm water nozzle which sprays warm water. The aforementioned cooling humidification means consists of a cold-water nozzle which sprays cold water, and the aforementioned cooling means consists of a cold-water coil. The aforementioned reheating means consists of a warm water coil, and it has the heat pump system which has a heat storage tank. It is the air cleaner according to claim 1 characterized by having connected the entrance side of each aforementioned warm water coil and a warm water nozzle to the elevated-temperature side of the aforementioned heat storage tank, and connecting the entrance side of each aforementioned cold-water coil and a cold-water nozzle to the low temperature side of the aforementioned heat storage tank.

[Claim 3] the air cleaner according to claim 2 characterized by forming an eliminator in the slipstream side of the aforementioned cold-water coil

[Claim 4] The aforementioned heat storage tank is an air cleaner according to claim 2 or 3 characterized by dividing the inside of a tub into the tub of two or more step story in temperature.

---

[Translation done.]

**BEST AVAILABLE COPY**

## \* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

BEST AVAILABLE COPY

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

## DETAILED DESCRIPTION

---

### [Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] Especially this invention relates to the air cleaner for open air processing of a clean room about an air cleaner.

[0002]

[Description of the Prior Art] In the outside tone machine which supplies the open air to a clean room, you have to remove the toxic substance of the shape of gas of SOX, NOX, or ammonia and others with a particle-like pollutant. In order to remove such harmful gas, the chemical filter containing adsorbents, such as activated carbon, is used. However, it is expensive, and a chemical filter has a life in the removal effect, and its judgment and work of an exchange stage are troublesome.

[0003] On the other hand, the harmful-gas catharsis by pyknosis is known apart from such a chemical filter. In this pyknosis method, by generating the steam atmosphere of the supersaturation which contains a particle first, a steam molecule carries out collision adhesion on a particle front face by thermal motion, and a thin liquid membrane is formed in the front face by using a particle as a nucleus. Furthermore, a steam molecule adheres to a nucleus front face, diffusion condensation is carried out and the diameter of a particle grows to several micrometers. This process is called nucleated condensation or uneven phase nucleation. In this condensation growth process, water-soluble harmful gas sticks to a particle front face with a steam molecule, and is absorbed by the water of condensation. Thus, the water of condensation is separated as a drain and the inertial dust collection of making the air containing the water of condensation which absorbed harmful gas collide with an eliminator etc. defecates air.

[0004] Such a pyknosis operation is obtained by including an air washer in an outside tone machine. Conventionally, sprayed the water of ordinary temperature by the nozzle, formed detailed waterdrop, the harmful-gas component was made to stick to this waterdrop, the eliminator separated this as the water of condensation in the air washer aiming at such harmful-gas removal, and pure air had been obtained.

[0005]

[Problem(s) to be Solved by the Invention] However, the air washer which sprays the water of the conventional ordinary temperature made harmful gas adsorb by contact to waterdrop and harmful gas, and is not removed, the principle of the above-mentioned pyknosis was not fully employed efficiently, and the harmful-gas removal effect by pyknosis operation was not fully demonstrated.

[0006] this invention aims at offer of an air cleaner which can fully demonstrate the gas-adsorption operation based on the principle of pyknosis, and can remove harmful gas effectively in consideration of the above-mentioned point.

[0007]

[Means for Solving the Problem] In order to attain the aforementioned purpose, in this invention, the air cleaner characterized by establishing a heating means, a heating humidification means, a cooling humidification means, a cooling means, and a reheating means is offered in order along the passage of air.

[0008] According to this composition, the air which should defecate is heated, and since it is humidified in the state where it was heated, absolute humidity can be raised, and when it changes into a supersaturation state, the amount of the steam molecule contained in air can be made [ many ]. Therefore, the gas adsorption in a pyknosis growth process is promoted, and harmful-gas removal efficiency is raised. Moreover, by considering as a heating state, the thermal motion of a steam molecule becomes active, the condensation growth operation by the collision to a particle front face is promoted, and harmful gas can be adsorbed still more efficiently.

[0009] Thus, while the steam which adsorbed harmful gas by adiabatic cooling by humidifying the air of the supersaturation state containing the particle which fully adsorbed harmful gas efficiently by pyknosis at low

BEST AVAILABLE COPY

Page 2 of 2

temperature condenses and being removed as a drop, it becomes air of a low-temperature supersaturation state further by humidification. By cooling the air of this supersaturation state further, while pyknosis is promoted, a steam condenses by adiabatic cooling again and it is removed as a drop. Thus, while adsorbing harmful gas more efficiently by building the supersaturation state of 2 times, giving two steps of cooling operations, and making a steam condense by adiabatic cooling, respectively, since the amount of condensation increases, the water of condensation which adsorbed harmful gas can fully be discharged as a drain.

[0010] Moreover, in order to cool the air of a supersaturation state, dew-point-temperature control is attained, the air state which met the saturation curve on the air state-line view is acquired, corresponding to the amount of cooling, a dew point temperature can adjust easily, and a desired air state is easily acquired with a sufficient precision by reheating this.

[0011] In the desirable example of composition, the aforementioned heating means consists of a warm water coil, and the aforementioned heating humidification means consists of a warm water nozzle which sprays warm water. The aforementioned cooling humidification means consists of a cold-water nozzle which sprays cold water, and the aforementioned cooling means consists of a cold-water coil. The aforementioned reheating means consists of a warm water coil, and it has the heat pump system which has a heat storage tank. It is characterized by having connected the entrance side of each aforementioned warm water coil and a warm water nozzle to the elevated-temperature side of the aforementioned heat storage tank, and connecting the entrance side of each aforementioned cold-water coil and a cold-water nozzle to the low temperature side of the aforementioned heat storage tank.

[0012] While the purge from which it is efficient and harmful gas is removed by the above-mentioned pyknosis method is realizable using warm water and cold water according to this composition, saving of energy can be aimed at using effectively the property of heat pump, and the property of a heat storage tank, and reduction of cost can be aimed at.

[0013] according to the still more desirable example of composition, it is characterized by forming an eliminator in the slipstream side of the aforementioned cold-water coil

[0014] According to this composition, after the drop which adsorbed harmful gas by discharging the water of condensation generated by two steps of cooling operations through a cold-water nozzle and a cold-water coil is removed, the inertial-dust-collection operation by the eliminator can be given further, and harmful gas can be removed more certainly.

[0015] In the still more desirable example of composition, the aforementioned heat storage tank is characterized by dividing the inside of a tub into the tub of two or more step story in temperature.

[0016] According to this composition, the inside of a heat storage tank is divided into the thermostat, a moderate temperature tub, and three tubs of a cryostat. By supplying warm water and cold water to each nozzle and a coil from the thermostat and a cryostat, and returning the warm water and cold water which return from each warm water, a cold-water nozzle, and a coil to a moderate temperature tub. The coldness-and-warmth water of a heat storage tank can be used efficiently, the heat loss by the mixture by the side of the elevated temperature in a tub and low temperature can be prevented, with the temperature distribution in a tub maintained, and the heat recovery by heat pump and the effect of efficiency operation by energy saving can fully be acquired.

[0017]

[Embodiments of the Invention] Drawing 1 is the block diagram of the air cleaner concerning the gestalt of operation of this invention. The reheater 6 which serves as the heater 1 which consists of a warm water coil, the humidifier 2 which consists of a warm water nozzle which sprays warm water, the washer 3 which consists of a cold-water nozzle which sprays cold water, the condensator 4 which consists of a cold-water coil, and an eliminator 5 from a warm water coil is formed along the airstream way F in the outside tone machine (not shown) which supplies the open air to a clean room. In order to air-condition this clean room or the other building interior of a room, the heat pump 8 which has a heat storage tank 7 is equipped. A heat storage tank 7 is divided into three tubs of thermostat 7a, moderate temperature tub 7b, and cryostat 7c in the inside of a tub, and it is open for free passage between each tub with the free passage sections 7d and 7e which consist of a double septum. It circulates through the warm water of thermostat 7a, and the cold water of cryostat 7c through the condenser and evaporator of heat pump 8, respectively, the warm water warmed by the condenser is returned to 7f of weir sections by the side of the elevated temperature of thermostat 7a, and the cold water cooled with the evaporator is returned to 7g of unlicensed weir sections by the side of the low temperature of cryostat 7c.

[0018] Cold energy and warm temperature are stored in this heat storage tank 7 by use of power etc. night, about 40-45-degree C warm water is stored in thermostat 7a, and about 5-7-degree C cold water is stored in cryostat 7c. A heat storage tank 7 is good also as thermal stratification type composition which formed the temperature gradient in the low temperature side from the elevated-temperature side without dividing the inside of the composition which separated

completely the tub of composition, the thermostat, and a cryostat itself which divided into two tubs by the side of an elevated temperature and low temperature not only the composition that divided the inside of a tub into three tubs like the example of drawing but the inside of a tub, and was made into the tub of another object, or a tub. Moreover, the heat-regenerative element by the side of a cryostat may be not only water but a ice thermal storage method

[0019] In the outside tone machine equipped with the heat pump 8 which has such a heat storage tank 7, the warm water of thermostat 7a of a heat storage tank 7 is supplied to a heater 1, an above-mentioned humidifier 2, and an above-mentioned reheater 6 from 7f of elevated-temperature side \*\*\*\*. The warm water which passed the heater 1 and the reheater 6 is returned to 7d of elevated-temperature side free passage sections of moderate temperature tub 7b, and the warm water injected with the humidifier (warm water washer) 2 is drained as a drain. The cold water of cryostat 7c is supplied to a washer 3 and a condensator 4 from 7g of unlicensed weir sections by the side of low temperature, and it is returned to low temperature side free passage section 7e of moderate temperature tub 7b, respectively. Moreover, the cooling section 4 and the drain water of an eliminator 5 are drained with the drain water of a warm water washer.

[0020] In such composition, it will be in the state which the OAT which flows the airstream way F which should be purified rises, and many steam components are included, and can raise absolute humidity with a heater 1 first. the air of a supersaturation state is obtained with the humidifier 2 by warm water spraying prepared in the slipstream side of this heater 1. In the air of this supersaturation state, while a steam molecule carries out condensation growth by pyknosis operation, the steam molecule which harmful gas condensed is adsorbed.

[0021] Then, by passing the washer 3 by cold-water spraying, the water of condensation by which adiabatic cooling of a part of air of a supersaturation state was carried out, and it adsorbed harmful gas liquefies as a drain, and is discharged. At this time, the air of a low-temperature supersaturation state is obtained according to cold-water spraying. Moreover, this washer 3 has the washing function in which contact to waterdrop and particles, such as dust in the open air, removes these particles directly with the harmful-gas removal function by the above-mentioned pyknosis operation.

[0022] Then, when the air of a low-temperature supersaturation state passes a condensator 4, the water of condensation which adsorbed harmful gas by pyknosis operation liquefies as drain water by adiabatic cooling, and it is discharged. By passing an eliminator 5 further, the open air which passed this condensator 4 liquefies as a drain by inertial impaction with this eliminator 5, and discharges the water of condensation which adsorbed harmful gas by the pyknosis operation which did not take and go out with the above-mentioned washer 3 and a condensator 4. In addition, when water-of-condensation eccrisis by the washer 3 and the condensator 4 is fully performed, you may omit this eliminator 5.

[0023] Thus, by passing a reheater 6, the open air from which harmful gas was removed by the water-of-condensation eccrisis by the eliminator 5 following the water-of-condensation eccrisis and this accompanied by two steps of cooling operations by the washer 3 and the condensator 4 is reheated, and air supply are carried out to a clean room. In this case, since the air before reheating is cooled along with the saturation curve in the air state-line view, when a dew point temperature is grasped certainly and adjusts the amount of heating of this reheater 6 by dew-point-temperature control, the indoor air state of a request required for a clean room is acquired.

[0024]

[Effect of the Invention] As explained above, in this invention, the air which should defecate is heated, and since it is humidified in the state where it was heated, when absolute humidity can be raised and it changes into a supersaturation state, the amount of the steam molecule contained in air can be made [ many ]. Therefore, the gas adsorption in a pyknosis growth process is promoted, and harmful-gas removal efficiency is raised. Moreover, by considering as a heating state, the thermal motion of a steam molecule becomes active, the condensation growth operation by the collision to a particle front face is promoted, and harmful gas can be adsorbed still more efficiently.

[0025] Moreover, by supplying warm water and cold water, respectively from an elevated-temperature [ of the heat storage tank connected with the heat pump system ], and low temperature side, saving of energy can be aimed at using effectively the coldness-and-warmth water which heat pump manufactures, reduction of cost can be aimed at, and the air cleaner of energy saving can be realized.

---

[Translation done.]

P

(51) Int.Cl. <sup>7</sup>	識別記号	F I	マーク <sup>8</sup> (参考)
B 0 1 D 53/34		B 0 1 D 53/34	E 3 L 0 5 3
53/77		A 6 1 L 9/00	C 4 C 0 8 0
A 6 1 L 9/00		B 0 1 D 47/05	4 D 0 0 2
B 0 1 D 47/05	53/18		E 4 D 0 2 0
53/18		F 2 4 F 3/14	4 D 0 3 2

審査請求 有 請求項の数4 OL (全5頁) 最終頁に続く

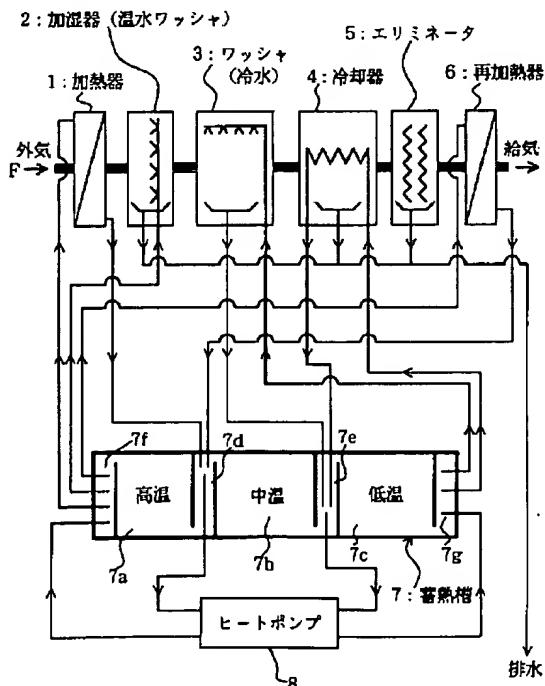
(21)出願番号	特願平10-218937	(71)出願人	000222956 東洋熱工業株式会社 東京都中央区京橋2丁目5番12号
(22)出願日	平成10年8月3日 (1998.8.3)	(72)発明者	柳原 茂 東京都中央区京橋二丁目5番12号 東洋熱 工業株式会社内
		(72)発明者	今井 智将 東京都中央区京橋二丁目5番12号 東洋熱 工業株式会社内
		(74)代理人	100100284 弁理士 荒井 潤
			最終頁に続く

## (54)【発明の名称】 空気浄化装置

## (57)【要約】

【課題】 核凝縮の原理に基づくガス吸着作用を充分に發揮して有害ガスを効果的に除去することができる空気浄化装置を提供する。

【解決手段】 空気の流路に沿って順番に、加熱手段1と、加熱加湿手段2と、冷却加湿手段3と、冷却手段4と、再加熱手段6とを設け、加熱および冷却用の冷温水はヒートポンプ8の蓄熱槽7から供給する。



## 【特許請求の範囲】

【請求項1】空気の流路に沿って順番に、加熱手段と、加熱加湿手段と、冷却加湿手段と、冷却手段と、再加熱手段とを設けたことを特徴とする空気浄化装置。

【請求項2】前記加熱手段は温水コイルからなり、前記加熱加湿手段は温水を噴霧する温水ノズルからなり、前記冷却加湿手段は冷水を噴霧する冷水ノズルからなり、前記冷却手段は冷水コイルからなり、前記再加熱手段は温水コイルからなり、蓄熱槽を有するヒートポンプシステムを備え、前記各温水コイルおよび温水ノズルの入口側は前記蓄熱槽の高温側に接続され、前記各冷水コイルおよび冷水ノズルの入口側は前記蓄熱槽の低温側に接続されたことを特徴とする請求項1に記載の空気浄化装置。

【請求項3】前記冷水コイルの後流側にエリミネータを設けたことを特徴とする請求項2に記載の空気浄化装置。

【請求項4】前記蓄熱槽は、槽内を温度的に複数段階の槽に分割されたことを特徴とする請求項2または3に記載の空気浄化装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は空気浄化装置に関し、特にクリーンルームの外気処理用空気浄化装置に関するものである。

## 【0002】

【従来の技術】クリーンルームに外気を供給する外調機においては、粒子状の汚染物質とともにSO<sub>2</sub>やNO<sub>x</sub>あるいはアンモニアその他のガス状の有害物質を除去しなければならない。このような有害ガスを除去するために活性炭などの吸着剤を含んだケミカルフィルターが用いられている。しかしながら、ケミカルフィルターは高価であり、また除去効果に寿命があり交換時期の判定や作業が面倒である。

【0003】一方、このようなケミカルフィルターとは別に、核凝縮による有害ガス浄化法が知られている。この核凝縮法においては、まず微粒子を含む過飽和の水蒸気霧團を生成することにより、水蒸気分子が熱運動により微粒子表面に衝突付着し、微粒子を核としてその表面に薄い液膜が形成される。さらに水蒸気分子が核表面に付着して拡散凝縮し、微粒子径が数μmまで成長する。この過程は有核凝縮あるいは不均一相核生成と呼ばれる。この凝縮成長過程において、水溶性の有害ガスが水蒸気分子とともに微粒子表面に吸着し、凝縮水に吸収される。このように有害ガスを吸収した凝縮水を含む空気を例えばエリミネータに衝突させる等の慣性集塵により、凝縮水がドレンとして分離され空気が清浄化される。

【0004】このような核凝縮作用は、外調機に例えば

エアワッシャを組込むことにより得られる。従来、このような有害ガス除去を目的としたエアワッシャにおいては、常温の水をノズルにより噴霧して微細な水滴を形成し、この水滴に有害ガス成分を吸着させてこれをエリミネータにより凝縮水として分離して清浄空気を得ていた。

## 【0005】

【発明が解決しようとする課題】しかしながら、従来の常温の水を噴霧するエアワッシャは、水滴と有害ガスとの接触により有害ガスを吸着させて除去するものであり、前述の核凝縮の原理が充分に生かされず、核凝縮作用による有害ガス除去効果が充分に発揮されなかった。

【0006】本発明は上記の点を考慮したものであつて、核凝縮の原理に基づくガス吸着作用を充分に発揮して有害ガスを効果的に除去することができる空気浄化装置の提供を目的とする。

## 【0007】

【課題を解決するための手段】前記目的を達成するため、本発明では、空気の流路に沿って順番に、加熱手段と、加熱加湿手段と、冷却加湿手段と、冷却手段と、再加熱手段とを設けたことを特徴とする空気浄化装置を提供する。

【0008】この構成によれば、清浄化すべき空気が加熱され、加熱された状態で加湿されるため、絶対湿度を高めることができ、過飽和状態にしたときに空気中に含まれる水蒸気分子の量を多くすることができる。したがって、核凝縮成長過程におけるガス吸着が促進され有害ガス除去効率が高められる。また、加熱状態とすることにより、水蒸気分子の熱運動が活発になり、微粒子表面への衝突による凝縮成長作用が促進され有害ガスをさらに効率よく吸着することができる。

【0009】このように核凝縮により有害ガスを効率よく充分に吸着した微粒子を含む過飽和状態の空気を低温で加湿することにより、断熱冷却により有害ガスを吸着した水蒸気が凝縮して液滴として除去されるとともに、加湿によりさらに低温の過飽和状態の空気となる。この過飽和状態の空気をさらに冷却することにより、核凝縮が促進されるとともに再び断熱冷却により水蒸気が凝縮して液滴として除去される。このように2度の過飽和状態をつくり、2段階の冷却作用を施してそれぞれ断熱冷却により水蒸気を凝縮させることにより、有害ガスをより効率よく吸着するとともに、凝縮量が多くなるため有害ガスを吸着した凝縮水をドレンとして充分に排出することができる。

【0010】また、過飽和状態の空気を冷却するため、露点温度制御が可能となって、空気状態線図上で飽和曲線に沿った空気状態が得られ、冷却量に対応して露点温度が容易に調整でき、これを再加熱することにより所望の空気状態が容易に精度よく得られる。

【0011】好ましい構成例では、前記加熱手段は温水

コイルからなり、前記加熱加湿手段は温水を噴霧する温水ノズルからなり、前記冷却加湿手段は冷水を噴霧する冷水ノズルからなり、前記冷却手段は冷水コイルからなり、前記再加熱手段は温水コイルからなり、蓄熱槽を有するヒートポンプシステムを備え、前記各温水コイルおよび温水ノズルの入口側は前記蓄熱槽の高温側に接続され、前記各冷水コイルおよび冷水ノズルの入口側は前記蓄熱槽の低温側に接続されたことを特徴としている。

【0012】この構成によれば、温水および冷水を用いて、前述の核凝縮法により高効率で有害ガスを除去する浄化装置を実現することができるとともに、ヒートポンプの特性と蓄熱槽の特性を有効に利用してエネルギーの節約を図りコストの低減を図ることができる。

【0013】さらに好ましい構成例によれば、前記冷水コイルの後流側にエリミネータを設けたことを特徴としている。

【0014】この構成によれば、冷水ノズルおよび冷水コイルを通して2段階の冷却作用により生成される凝縮水を排出することによって有害ガスを吸着した液滴が除去された後、さらにエリミネータによる慣性集塵作用を施して有害ガスをより確実に除去することができる。

【0015】さらに好ましい構成例では、前記蓄熱槽は、槽内を温度的に複数段階の槽に分割されたことを特徴としている。

【0016】この構成によれば、蓄熱槽内を例えば高温槽、中温槽および低温槽の3槽に分割し、高温槽および低温槽から温水および冷水を各ノズルおよびコイルに供給し、各温水および冷水ノズルおよびコイルからの還りの温水および冷水を中温槽に戻すことにより、槽内の温度分布を保ったまま、効率的に蓄熱槽の冷温水を利用し、槽内の高温側と低温側の混合による熱損失を防ぎ、ヒートポンプによる熱回収や省エネルギーによる効率運転の効果を十分に得ることができる。

【0017】

【発明の実施の形態】図1は、本発明の実施の形態に係る空気浄化装置の構成図である。クリーンルームに外気を供給する外調機（図示しない）内の空気流路Fに沿って、温水コイルからなる加熱器1と、温水を噴霧する温水ノズルからなる加湿器2と、冷水を噴霧する冷水ノズルからなるワッシャー3と、冷水コイルからなる冷却器4と、エリミネータ5と、温水コイルからなる再加熱器6が設けられる。このクリーンルームあるいはその他の建物室内を空調するために蓄熱槽7を有するヒートポンプ8が備わる。蓄熱槽7は槽内を、高温槽7a、中温槽7bおよび低温槽7cの3槽に分割され、各槽間は2重隔壁からなる連通部7dおよび7eにより連通している。高温槽7aの温水および低温槽7cの冷水は、それぞれヒートポンプ8の凝縮器および蒸発器を介して循環し、凝縮器で暖められた温水は高温槽7aの高温側の堰部7fに戻され、蒸発器で冷やされた冷水は低温槽7c

の低温側のもぐり堰部7gに戻される。

【0018】この蓄熱槽7には例えば夜間電力の利用等により冷熱や温熱が蓄えられ、高温槽7aには40～45°C程度の温水が蓄えられ、低温槽7cには5～7°C程度の冷水が蓄えられる。蓄熱槽7は図の例のように槽内を3槽に分割した構成に限らず、槽内を高温側と低温側の2槽に分割した構成や高温槽と低温槽の槽自体を完全に分離して別体の槽とした構成あるいは槽内を分割しないで高温側から低温側に温度勾配を形成した温度成層型の構成等としてもよい。また、低温槽側の蓄熱体は水に限らず、氷蓄熱方式であってもよい。

【0019】このような蓄熱槽7を有するヒートポンプ8を備えた外調機において、前述の加熱器1、加湿器2および再加熱器6には、蓄熱槽7の高温槽7aの温水が高温側堰部7fから供給される。加熱器1および再加熱器6を通過した温水は、中温槽7bの高温側連通部7dに戻され、加湿器（温水ワッシャ）2で噴射された温水はドレンとして排水される。ワッシャ3および冷却器4には低温槽7cの冷水が低温側のもぐり堰部7gから供給され、それぞれ中温槽7bの低温側連通部7eに戻される。また、冷却部4およびエリミネータ5のドレン水は温水ワッシャのドレン水とともに排水される。

【0020】このような構成において、最初に加熱器1により、浄化すべき空気流路Fを流れる外気温度が上昇し、水蒸気成分を多く含ませて絶対湿度を高めることができた状態となる。この加熱器1の後流側に設けた温水噴霧による加湿器2により、過飽和状態の空気が得られる。この過飽和状態の空気の中で、核凝縮作用により水蒸気分子が凝縮成長するとともに有害ガスが、凝縮した水蒸気分子に吸着される。

【0021】続いて、冷水噴霧によるワッシャー3を通過することにより、過飽和状態の空気の一部が断熱冷却されて有害ガスを吸着した凝縮水がドレンとして液化して排出される。このとき、冷水噴霧により、低温の過飽和状態の空気が得られる。また、このワッシャー3は、上記核凝縮作用による有害ガス除去機能とともに、水滴と外気中の塵埃等の微粒子との接触により直接これらの微粒子を除去する洗浄機能を有する。

【0022】続いて、低温の過飽和状態の空気が冷却器4を通過することにより、断熱冷却により、核凝縮作用により有害ガスを吸着した凝縮水がドレン水として液化して排出される。この冷却器4を通過した外気は、さらにエリミネータ5を通過することにより、上記ワッシャー3および冷却器4で取り切らなかった核凝縮作用により有害ガスを吸着した凝縮水を、このエリミネータ5との慣性衝突によりドレンとして液化して排出する。なお、このエリミネータ5は、ワッシャー3および冷却器4による凝縮水排出が充分に行われる場合には省略してもよい。

【0023】このように、ワッシャー3および冷却器4

による2段階の冷却作用を伴う凝縮水排出およびこれに続くエリミネータ5による凝縮水排出により有害ガスが除去された外気は、再加熱器6を通過することにより、再加熱されクリーンルームに給気される。この場合、再加熱前の空気は、空気状態線図において、飽和曲線に沿って冷却されているため、露点温度制御によって、露点温度が確実に把握され、この再加熱器6の加熱量を調整することにより、クリーンルームに必要な所望の室内空気状態が得られる。

## 【0024】

【発明の効果】以上説明したように、本発明においては、清浄化すべき空気が加熱され、加熱された状態で加温されるため、絶対湿度を高めることができ、過飽和状態にしたときに空気中に含まれる水蒸気分子の量を多くすることができる。したがって、核凝縮成長過程におけるガス吸着が促進され有害ガス除去効率が高められる。また、加熱状態とすることにより、水蒸気分子の熱運動

が活発になり、微粒子表面への衝突による凝縮成長作用が促進され有害ガスをさらに効率よく吸着することができる。

【0025】また、ヒートポンプシステムと接続された蓄熱槽の高温側および低温側から温水および冷水をそれぞれ供給することにより、ヒートポンプが製造する冷温水を有効に利用してエネルギーの節約を図りコストの低減を図って、省エネルギーの空气净化装置を実現することができる。

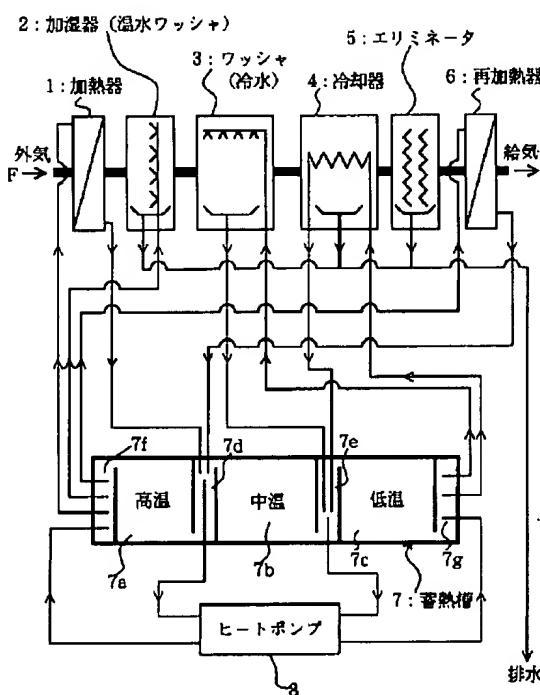
## 10 【図面の簡単な説明】

【図1】 本発明の実施の形態に係る空气净化装置の構成図。

## 【符号の説明】

1：加熱器、2：加湿器、3：ワッシャー、4：冷却器、5：エリミネータ、6：再加熱器、7：蓄熱槽、8：ヒートポンプ。

【図1】



## 【手続補正書】

【提出日】平成11年7月12日(1999.7.12)

## 【手続補正1】

【補正対象書類名】明細書

【補正対象項目名】請求項1

【補正方法】変更

## 【補正内容】

【請求項1】空気の流路に沿って順番に、加熱手段と、加熱加温手段と、冷却加湿手段と、冷却手段と、再加熱手段とを設けることにより2段階の核凝縮浄化構造を形成したことを特徴とする空气净化装置。

フロントページの続き

(51) Int.C1.7 )	識別記号	F I	テ-マ-ト (参考)
F 2 4 F 3/14 3/16		F 2 4 F 3/16	
(72) 発明者 岩宮 正治 東京都中央区京橋二丁目5番12号 東洋熱 工業株式会社内		F ターム(参考) 3L053 BC06 BC08 BD02 4C080 AA05 BB02 BB05 CC01 CC12 HH02 JJ01 KK02 KK06 LL02 MM01 QQ11 QQ14 QQ20 4D002 AA02 AA12 AA13 AA40 BA02 BA12 BA13 BA14 BA16 CA01 DA35 EA02 4D020 AA05 AA06 AA10 BB03 CB25 CD01 CD02 4D032 AC01 AE04 BA06 BB01	

PAT-NO: JP02000042350A  
DOCUMENT-IDENTIFIER: JP 2000042350 A  
TITLE: AIR PURIFYING DEVICE  
PUBN-DATE: February 15, 2000

INVENTOR- INFORMATION:  
NAME COUNTRY  
YANAGIHARA, SHIGERU N/A  
IMAI, TOMOMASA N/A  
IWAMIYA, MASAHIRO N/A

ASSIGNEE- INFORMATION:  
NAME COUNTRY  
TOYO NETSU KOGYO KK N/A

APPL-NO: JP10218937  
APPL-DATE: August 3, 1998

INT-CL (IPC): B01D053/34, B01D053/77, A61L009/00, B01D047/05, B01D053/18  
, F24F003/14, F24F003/16

ABSTRACT:

PROBLEM TO BE SOLVED: To effectively remove a harmful gas by heating air to be purified and humidifying the air in the heated state to sufficiently exhibit gas adsorption action based on the principal of nucleus condensation.

SOLUTION: The temp. of outside air to be purified flowing through an air passage F is increased by a heater 1 at first to make such a state that absolute humidity can be increased by adding a lot of steam component. Air in a supersaturated state is obtained by atomizing hot water by a humidifier 2 provided in the succeeding flow side of the heater 1. The steam molecule in the air in the supersaturated state is condensed and grown by the nucleus condensation action and the harmful gas is adsorbed by the condensed steam molecule. Next, the outside air from which the harmful gas is removed by the discharge of the condensed water with two stages of cooling action by a washer 3 and a cooler 4 and the succeeding discharge of the condensed water with an eliminator 5 is passed through a re-heater 6 to be re-heated and supplied to a clean room.

COPYRIGHT: (C) 2000, JPO